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EXAMINER	
FOWLKES, ANDRE R	
ART UNIT	**PAPER NUMBER**
2192	

DATE MAILED: 04/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/964,769	MARKSTEIN ET AL.	
	Examiner	Art Unit	
	Andre R. Fowlkes	2192	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11/3/04*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This action is in response to the amendment filed 11/3/04.

Specification

2. The objection to the disclosure is withdrawn, in view of applicant's amendment.

Claim Objections

3. The objection to the claims is withdrawn, in view of applicant's amendment.

Claim Rejections - 35 USC § 101

4. The rejection under 35 U.S.C. 101 to claims 1-12 is withdrawn, in view of applicant's amendment.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1-3, 6-9, 12-15, 18-21, 24 and 26-28 are rejected under 35 U.S.C. 102(e) as being anticipated by Loginov, U.S. Patent No. 6,567,831.

As per claim 1, Loginov discloses **a compiler used by a computer architecture to compile a family of related functions** (col. 1:13-15, "The present invention relates ... particularly to compilers", and col. 2:6-7, "to optimize it for use in function evaluation (for a family of related functions)"), comprising:

- a member recognizer configured to recognize a member function from said family of related functions (col. 2:52-55, "overall improvement in processing speed in the evaluation of certain (families of) functions is achieved by (recognizing a member function from a family of functions that can be evaluated using a Taylor series expansion, then) representing each function as a series expansion"),

- a family start caller configured to make a family-start function call for said family of related functions (col. 2:66-3:1, "the first step of the method ... is to divide the range of argument values for the approximation into n intervals", and this is done for all members of the family or related functions),

- a member finish caller to make a member-finish function call for said member function (col. 3:14-16, "Next, to compute, for example, the sqrt(x) function, in accordance with the present invention, the following (member specific finish call) is used", and col. 4:8-10, "Finally, in accordance with a preferred embodiment, reduction of the argument (i.e. a member finisher call) to the required approximation range and obtaining of the final result".

As per claim 2, the rejection of claim 1 is incorporated and further, Loginov discloses **an optimizer configured to optimize at least one of said family-start or member finish function calls** (col. 4:54-55, "(optimizing the speed of execution time by) replacing multiplication operations with additions (i.e. optimizing the components of the family-start and member finisher functions)").

As per claim 3, the rejection of claim 2 is incorporated and further, Loginov discloses that the **optimizer is configured to optimize on at least one of intermediate language level, architecture specific level, or operating system specific level** (col. 1:46-47, "(the) compiler (optimizes and) processes these instructions according to precise conformance to the structure of the processor (i.e. architecture specific level)").

As per claim 6, the rejection of claim 1 is incorporated and further, Loginov discloses that **said family of related functions includes at least one of trigonometric, hyperbolic, or square root functions** (col. 2:60, "parallel algorithms are provided for the fast computation of (families of related) functions, such as sqrt(x), cbrt(x), and ln(x)").

As per claim 7, the rejection of claim 1 is incorporated and further, Loginov discloses that **said family of related functions is identified by use of a data store** (Fig. 1 item 40, "I-cache (i.e. data store)", and associated text, (e.g. col. 2:23-65).

As per claim 8, the rejection of claim 7 is incorporated and further, Loginov discloses that **data store includes at least one of a look-up table, an ASCII file, a binary file, or a database file** (col. 2:51-55, "certain functions ... (are) stored in a (look up) table").

As per claim 9, the rejection of claim 7 is incorporated and further, Loginov discloses that **said data store is modifiable** (col. 2:51-55, "certain functions ... (are) stored in a table (i.e. a modifiable data store)").

As per claim 12, the rejection of claim 1 is incorporated and further, Loginov discloses that **said member-finish function call makes use of a result returned from said family-start function call** (col. 2:66-3:6, "the first step of the method ... is to divide the range of argument values for the approximation into n intervals (i.e. the family start function) ... next, for each of the n intervals, the value of the function at the center x0 of the range is determined", and col. 3:14-21, "Next, to (apply the member finish function for) ... the sqrt(x) function, ... the values of sqrt(x0) and sqrt(x0)/x0^m are computed").

As per claim 25, the rejection of claim 1 is incorporated and further, Loginov discloses that **at least one calculation is almost identical for each member function of the family of related functions** (col. 3:45-47, "It can be appreciated, that formulae

similar to Eqns. 1 and 2 can easily be derived for a number of additional functions, such as the cubic root cbrt, and the ln functions").

As per claim 26, the rejection of claim 25 is incorporated and further, Loginov discloses that **at least one calculation is identical for each member function of the family of related functions** (col. 3:50-52, "the values of the function at the x.sub.0 point and the powers of x.sub.0, as required in the expansion can be obtained and stored").

As per claims 13-15, 18-21, 24, 27 and 28, this is a method version of the claimed compiler discussed above, in claims 1-3, 6-9, 12, 25 and 26, wherein all claimed limitations have also been addressed and/or cited as set forth above. For example, see Loginov's computer system and method for parallel computations using table approximations (col. 1:13-4:55).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 4, 5, 10, 11, 16, 17, 22 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Loginov, U.S. Patent No. 6,567,831 in view of Aho et al., (Aho), "Compilers: Principles, Techniques, and Tools", ISBN: 0-201-10088-6.

As per claim 4, the rejection of claim 2 is incorporated and further, Loginov doesn't explicitly disclose that the optimizer is configured to **in-line expand** at least one of said family-start or member-finish calls.

However, Aho, in an analogous environment, discloses that the optimizer is configured to **in-line expand** at least one of said family-start or member-finish calls (p. 428:25-26, "in-line expansion ... for reducing the running time of a program").

Therefore, it would have been obvious to a person of ordinary skill in the art, at the time the invention was made, to incorporate the teachings of Aho into the system of Loginov to have the optimizer configured to use in-line expansion. The modification would have been obvious because one of ordinary skill in the art would have wanted to decrease the running time of program code (Aho, p. 428:25-26).

As per claim 5, the rejection of claim 2 is incorporated and further, Loginov doesn't explicitly disclose that the **optimizer includes common subexpression elimination, code motion, and dead-code elimination**.

However, Aho, in an analogous environment, discloses that the **optimizer includes common subexpression elimination, code motion, and dead-code elimination** (p. 592:10-12, "Common subexpression elimination ... (and) dead-code

elimination ... are common examples of such function preserving transformations", and p. 596:12-13, "An important modifications that decrease the amount of code in a loop is code motion").

Therefore, it would have been obvious to a person of ordinary skill in the art, at the time the invention was made, to incorporate the teachings of Aho into the system of Loginov to have the optimizer include common subexpression elimination, code motion, and dead-code elimination. The modification would have been obvious because one of ordinary skill in the art would have wanted to use these well-known optimization techniques to reduce the running time of the program code.

As per claim 10 the rejection of claim 1 is incorporated and further, Loginov doesn't explicitly disclose that one or both of said family start caller and said member finish caller are configured to make said family-start and member-finish **function calls, respectively, in an intermediate language**.

However, Aho, in an analogous environment, discloses making **function calls in an intermediate language** (p. 463:1-3, "the front end translates a source program into an intermediate (language) representation from which the back end generates target code").

Therefore, it would have been obvious to a person of ordinary skill in the art, at the time the invention was made, to incorporate the teachings of Aho into the system of Loginov to make **function calls in an intermediate language.** The modification would have been obvious because one of ordinary skill in the art would have wanted the

option of applying a machine independent code optimizer to the intermediate language representation (Aho, p. 463:7-11).

As per claim 11, the rejection of claim 10 is incorporated and further, Loginov doesn't explicitly disclose that **said intermediate language is non-architecture specific and non-operating system specific**.

However, Aho, in an analogous environment, discloses that **said intermediate language is non-architecture specific and non-operating system specific** (p. 463:1-3, "the front end translates a source program into an (non-architecture and non-operating system specific) intermediate (language) representation from which the back end generates target code").

Therefore, it would have been obvious to a person of ordinary skill in the art, at the time the invention was made, to incorporate the teachings of Aho into the system of Loginov so that **said intermediate language is non-architecture specific and non-operating system specific.** The modification would have been obvious because one of ordinary skill in the art would have wanted the option of retargeting the intermediate representation to a different machine simply by attaching the back end for the new machine to the existing front end (Aho, p. 463:7-11).

As per claims 16, 17, 22, and 23, this is a system version of the claimed method discussed above, in claims 4, 5, 10 and 11, wherein all claimed limitations have also

been addressed and/or cited as set forth above. For example, see the Loginov/Aho combination, (Loginov, col. 1:13-4:55 and Aho, p. 428:25-596:13).

Response to Arguments

9. Applicants arguments have been considered but they are not persuasive.

In the remarks, the applicant has argued substantially that:

1) Loginov fails to teach a member recognizer configured to recognize a member function from said family of related functions, at p. 16:20-17:19 and p. 18:4-5.

Examiner's response:

1) Loginov does teach a member recognizer that recognizes and evaluates functions belonging to the group of functions that can be decomposed and evaluated using a Taylor series expansion (e.g. sqrt(x), cbrt(x) and ln(x)).

In the remarks, the applicant has argued substantially that:

2) Loginov does not teach a family start caller configured to make a family-start function call for said family of related functions and a member finisher caller to make a member-finish function call for said member functions, at p. 17:20-18:15.

Examiner's response:

2) The examiner disagrees with applicant's characterization of the applied art. Loginov teaches a family-start function call col. 3:50-52, "the values of the function at the x.sub.0 point and the powers of x.sub.0, as required in the expansion can be obtained (using a family start function) and stored". The member finisher function is disclosed at col. 4:8-10, "Finally, in accordance with a preferred embodiment, reduction of the argument (i.e. a member finisher call) to the required approximation range and obtaining of the final result".

In the remarks, the applicant has argued substantially that:

3) Neither Aho nor Loginov teach the features of independent claims 1 and 13, at p. 19:22-23.

Examiner's response:

3) Applicant's arguments fail to comply with 37 CFR 1. 1 1 1(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references. The Examiner has cited the relevant portions of the Loginov/Aho combination reference that are believed to be obvious over the Limitations of Applicant's claimed invention. Applicant has not asserted any technical argument, supported by proper evidence, against these references.

In the remarks, the applicant has argued substantially that:

4) Since Loginov discloses function evaluation performed in a compile time environment instead of a run-time environment, as disclosed by Aho, it would not have been obvious to combine Aho with Loginov, at p. 19:24-20:2.

Examiner's response:

4) Both Loginov and Aho disclose using a compiler and code optimization techniques that are in the same field of endeavor.

In the remarks, the applicant has argued substantially that:

5) Aho does not teach that subexpression elimination, code motion, and dead-code elimination may be used as function preserving transformations specifically by a compiler configured to optimize at least one of said family-start or member finish calls, as instantly claimed, at p. 20:3-8

Examiner's response:

5) The applicant appears to be arguing limitations that are not claimed. Specifically, the limitation "may be used as function preserving transformations specifically by a compiler configured to optimize at least one of said family-start or member finish calls" is not present in the claims.

In the remarks, the applicant has argued substantially that:

6) Aho does not disclose the limitations of claim 11 and further that nowhere does Aho specifically teach that the front end of a compiler translates a source program into an non-architecture specific and non-operating system specific intermediate language representation from which the back end generates target code , at p. 20:9-21:1

Examiner's response:

6) The Aho/Loginov combination teaches using an intermediate language representation that is non- architecture specific and non-operating system specific, as disclosed above in the rejection of claim 11 and further, the optimization of an intermediate language that is non architecture or operating system specific, is a well known and documented technique to one of ordinary skill in the art.

Additionally, the applicant appears to be arguing limitations that are not claimed. Specifically, the limitation that "the front end of a compiler translates a source program into an non-architecture specific and non-operating system specific intermediate language representation from which the back end generates target code" is not present in the claims.

In the remarks, the applicant has argued substantially that:

7) The Examiner provides no specific teaching by Loginov and/or Aho to support the rejection of claims 16, 17, 22 and 23, at p. 21:3-9.

Examiner's response:

7) The Examiner provides specific teachings by Loginov and Aho to support the rejection of claims 16, 17, 22 and 23 in the art rejection, above.

In the remarks, the applicant has argued substantially that:

8) Since Aho describes call-by-name procedures, function preserving transformations and intermediate code generation in the context of a run-time environment, as opposed to a compilation environment as disclosed in the instant application, Aho fails to provide any suggestion to render the claims obvious and it would not have been obvious to combine Aho with Loginov, at p. 21:10-17.

Examiner's response:

8) Both Loginov and Aho disclose using a compiler and code optimization techniques and are in the same field of endeavor.

In the remarks, the applicant has argued substantially that:

9) Newly added claims 25-28 are allowable over Loginov in view of Aho, at p. 21:19-22:4.

Examiner's response:

9) All newly added and amended claims have been addressed in the art rejection, above.

Conclusion

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Andre R. Fowlkes whose telephone number is (571) 272-3697. The examiner can normally be reached on Monday - Friday, 8:00am-4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tuan Q. Dam can be reached on (571)272-3695. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Any inquiry of a general nature or relating to the status of this application should be directed to the **TC 2100 Group receptionist: 571-272-2100.**

ARF

TUAN DAM
SUPERVISORY PATENT EXAMINER